



AFRL-RH-AZ-TR-2009-0009

**Behavioral and Psychosocial Considerations in
Intelligence Analysis: A Preliminary review of
Literature on Critical Thinking Skills**

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March 2009

Interim Report for May 2008 to October 2008

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**Air Force Research Laboratory
Human Effectiveness Directorate
Warfighter Readiness Research Division**

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REPORT DOCUMENTATION PAGE

*Form Approved
OMB No. 0704-0188*

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1. REPORT DATE (DD-MM-YYYY) 23-03-2009	2. REPORT TYPE Interim	3. DATES COVERED (From - To) 1 Oct 2006 – 1 Oct 2008		
4. TITLE AND SUBTITLE Behavioral and Psychosocial Considerations in Intelligence Analysis		5a. CONTRACT NUMBER N/A		
		5b. GRANT NUMBER N/A		
		5c. PROGRAM ELEMENT NUMBER 65502F		
6. AUTHOR(S) 2d Lt Chin Ki Tam		5d. PROJECT NUMBER 1123		
		5e. TASK NUMBER AS		
		5f. WORK UNIT NUMBER 1123AS15		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Continuous Learning Branch (711HPW/RHAS) Warfighter Readiness Research Division 6030 South Kent Street Mesa AZ 85212-6061		8. PERFORMING ORGANIZATION REPORT NUMBER N/A		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Research Laboratory Human Effectiveness Directorate Warfighter Readiness Research Division 6030 South Kent Street Mesa AZ 85212-6061		10. SPONSOR/MONITOR'S ACRONYM(S) AFRL; AFRL/RHA		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S) AFRL-RH-AZ-TR-2009 -0009		
12. DISTRIBUTION / AVAILABILITY STATEMENT DISTRIBUTION A. Approved for public release; distribution is unlimited. Approval given by 88 ABW/PA, 88ABW-2009-3152 14 Jul 09.				
13. SUPPLEMENTARY NOTES This research was conducted as an in-house effort as a response to ACC/A2RT's request for help				
14. ABSTRACT As a response to Air Combat Command (ACC/A2RT), the 711HPW/RHAS reviewed published literature on critical thinking skills and training to enhance skills as they relate to improving performance of intelligence analysts. While there are many critical training curriculums available in the intelligence community, current literature shows a lack of empirical evidence correlating critical thinking and intelligence analysis. This report suggests some considerations for an effective critical thinking curriculum as it relates to intelligence analysis.				
15. SUBJECT TERMS Intelligence analysis, Critical thinking, Training,				
16. SECURITY CLASSIFICATION OF:		17. LIMITATION OF ABSTRACT UNLIMITED	18. NUMBER OF PAGES 17	19a. NAME OF RESPONSIBLE PERSON Geoffrey Barbier
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED		19b. TELEPHONE NUMBER (include area code) 480-988-6561

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Executive Summary

The 711 Human Performance Wing Continuous Learning Branch (711HPW/RHAS) has been working with Air Combat Command/ (ACC/A2RT) for the past 5 years in the Intelligence, Surveillance, and Reconnaissance (ISR) training research domain. During an information exchange meeting in January 2008 at Langley AFB, ACC/A2RT requested help to find empirical evidence that links critical thinking to intelligence analysis. Specifically, is it possible to teach critical thinking skills to intelligence analysts to improve their analytical skills, and what would a critical thinking curriculum consist of? This report describes initial review of published literature on critical thinking skills and training to enhance skills as they relate to improving performance of intelligence analysts.

For this effort, with the support of two Air Force Academy cadets, we conducted a review of published literature within the psychology, education, and intelligence domain related to critical thinking skills. From this initial review, I produced a more comprehensive report detailing: 1) what we know, 2) what we do not, 3) what methods have been used to train/develop/promote what we defined as critical thinking as it relates to intelligence analysis, and 4) what are some of the challenges and issues.

Currently few have thoroughly investigated and written about the linkage between critical thinking and intelligence analysis. We can, however, draw upon the research in critical thinking in the educational and psychology domain to lead us forward. Within these domains, there are a variety of definitions of critical thinking and its components. There are also a plethora of curriculums developed that claim to improve critical thinking. We must identify the critical thinking skills as it relates to intelligence analysis before we can identify a training curriculum. A second issue exists as there is currently no true assessment for intelligence analysis. Much more research is needed to provide an answer to how critical thinking may improve intelligence analysis.

Behavioral and Psychosocial Considerations in Intelligence Analysis

Background

Two Air Force academy cadets, C1C Mark Bailie and Trent Atwood, worked at ARFL in Mesa for a summer research internship. During their stay in Mesa, they produced an initial annotated bibliography that kick started the research (appendix A). In the following months, I continued to broaden the literature search.

After the initial review in current literature, we found that few have investigated the link between critical thinking and intelligence analysis. While there has been work trying to link the two, there has not been any empirical evidence showing the correlation. Many authors speculate that the link does exist but no definitive correlation exists currently. In order for that to happen, two issues must be resolved: a) criteria matrix for scoring intelligence analysis and b) tools or methodologies to quantitatively measure that. At the present neither of these issues has been solved. Within the limited scope of this effort, it may be unrealistic to establish a definitive link between critical thinking skills and intelligence analysis. Rather than trying to solve these issues in this effort, we began to identify within the instructional design and learning theory literature on how novices learn. Furthermore, we propose a possibility of using digital games to teach critical thinking in regards to intelligence analysis and mapping the rationales back to established principles of learning theories.

Methods

In a response to ACC/A2RT's request for help, we began a broad literature search on relevant literature in the educational, psychology, and operational intelligence domain. I combined relevant findings in these disparate fields to address some of the issues on critical thinking as it relates to intelligence analysis.

Results

Critical Thinking

After the initial literature search, I focused on critical thinking skills and training strategies designed to enhance a person's critical thinking skills. Within the education and training communities, there is a myriad of definitions for critical thinking and critical thinking skills. According to Moore (2007), critical thinking is defined as:

...a deliberate meta-cognitive and cognitive act whereby a person reflects on the quality of the reasoning process simultaneously while reasoning to a conclusion. The thinker has two equally important goals: coming to a solution and improving the way she or he reasons. (p.8)

Another similar definition by Halpern (2002):

...critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is...thinking that is purposeful, reasoned, and goal directed – the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective to the particular context and type of thinking task. (p. 37)

Just as there is no universal definition for critical thinking, there is no consensus on what qualifies as critical thinking skills. From February 1988 to the end of November 1989, the American Philosophical Association put together a panel of experts from the Education, Social Sciences, and Physical Sciences domain to participate in the Delphi project. The Delphi project was an attempt to come to some consensus statement regarding critical thinking and the ideal critical thinker and present recommendations for future work. Under this project, Facione (1990) composed a consensus set of critical thinking cognitive skills and subskills. The skills and subskills are listed in table 1 below.

Table 1	
Consensus list of CT Cognitive Skills and Sub Skills	
Skills	Subskills
1) Interpretation	Categorization
	Decoding significance
	Clarifying meaning
2) Analysis	Examining ideas
	Identifying arguments
	Analyzing arguments
3) Evaluation	Assessing claims
	Assessing arguments
4) Inference	Querying evidence
	Conjecturing alternatives
	Drawing conclusions
5) Explanation	Stating results
	Justifying procedures
	Presenting arguments
6) Self-regulation	Self-examination
	self-correction

What is clear is that there seem to be some overlaps. That is that experts tend to agree that there are some commonalities amongst the varied understanding of critical thinking. As Lipman (1988) suggests critical thinking is "skilful, responsible thinking that facilitates good judgment because it (1) relies upon criteria, (2) is self-correcting, and (3) is sensitive to context" (p. 39). Lipman agrees that the quality of thinking is more important than the process of thinking; that we need to employ criteria upon which to examine our thinking and facilitate judgment. A second component to critical thinking is that thinking is self-correcting. At every step of thinking, we reflect on our thinking against the criteria we've established. And finally that the criteria established will be both general and context specific.

In regards to correlation between critical thinking and intelligence analysis, Heur (1999) is one of the few notable authors defining the issue. He suggests that errors occurring in analysis are due to limitations of cognition. He cites that it is cognitive biases or simplified information processing strategies that lead to flawed analysis. He defines these as: selectivity bias, availability bias, absence of evidence bias, confirmation bias, overconfidence bias, oversensitivity to consistency bias, and discredited evidence bias. Definitions of each type of biases are in table 2. These biases have been thoroughly researched and demonstrated in the numerous psychological experiments.

Table 2	
Types of Heur's biases	
Selectivity bias	Information is selectively recalled as a function of how vivid, concrete, and/or personal an event is
Availability bias	Prediction of the frequency of an event is based on how easily it is recalled
Absence of evidence bias	Most do not recognize and incorporate missing data into judgment of abstract problems
Confirmation bias	Tendency to perceive events in such a way as to confirm existing beliefs
Overconfidence bias	Overconfidence in one's own judgment on that they are correct when in fact most of the time they are wrong
Oversensitivity to consistency bias	Tendency to place too much reliance on small samples or the inability to discern multiple reports from same source
Discredited evidence bias	Impressions tend to persist even after the evidence that created those impressions has been fully discredited.

In order to prevent these biases from occurring, the analyst must understand what they are and reflect upon them at each stage of analysis. In other words, metacognition or reflective thinking is an important part of good analysis. Moore (2007) further maintains that:

Critical thinking mitigates error by providing means to assess errors in reasoning as they occur and before they become systematic failures (p. 81)

He asserts that self-questioning must occur at every analytical step. That is reflective thinking when assessing information, assessing evidence, creating inferences, and in producing intelligence is essential.

Learning Theories

To begin formulation of strategies for teaching critical thinking skills, the issue of domain transfer versus domain dependent must be tackled. There is evidence to suggest that both may be occurring. McMurray and Thompson (1989) and Anderson and Soden (2001) found that critical thinking skills learned in one domain did not easily and readily transfer to a novel domain. However, Lehman and Nisbett (1990), Kosonen & Winne (1995), and Nisbett (1993) found that skills obtained in one domain did indeed transfer to another domain. Halpern (1998) proposed a model of teaching critical thinking skills to facilitate the transfer across domains. The model consists of four parts: 1) a dispositional or attitudinal component, 2) instruction in and practice with critical thinking skills, 3) structure-training activities designed to facilitate transfer across contexts, and 4) a metacognitive component used to direct and assess thinking. For the purpose of this review, we will take the stance that critical thinking skills can be transfer across domains. That is teaching general critical thinking skills will lead to improvement in intelligence analysis.

Drawing from the education domain and learning theory, there also seems to be no consensus as to what approach is best for learning. Programs, strategies, and training programs are important but for it to be effective it is contingent on a variety of other factors. One such factor is the student's current ability. Clark and Wittrock (2000, as cited in Goodwin 2006) found a big interaction between aptitude and training. He conceptualized training to be of four types that range on a continuum between external to internal factors to the learner. The four types of training are: receptive (teaching by telling), behavioral (teaching by demonstration and feedback), guided discovery (teaching by problem solving), and exploratory (teaching by exploration). Research suggests while guided discovery and exploratory training worked well for individuals with high aptitude and motivation, it did not work well for novices with low aptitude. The important implication here is to tailor the training approach to the student's level of ability. Additionally, drawing from cognitive load theory novices initially learn better in well structured learning environment (Jonassen, 1997). That is learning using worked out examples is effective for novices as noted by the worked example effect (Clark, Nguyen, and Sweller, 2006). Using worked examples, teachers can use scaffolding by modeling the desired learning strategy or task. However, as a learner becomes more knowledgeable there is a gradual decline in the effectiveness in using well structured learning environments such as demonstrated by the expertise reversal effect (Kalyuga, Ayres, Chandler, and Sweller, 2003). The consensus is that a continuum of well structured to ill-structured learning environments be used as learners become

more knowledge in the domain. Problem solving scenarios are more effective during the later stages of learning; where the learner has to define the problem. Additionally, in the beginning stages of learning collaborative environments have been shown to be effective. Remedios, Clarke and Hawthorne (2008, p.2) suggests that it is “the opportunity to share a large workload, learn from multiple perspectives, distribute the cognitive load, negotiate shared understanding, develop social skills, and function as a content expert for a group peer” that has been deemed advantageous through collaborative learning. Because of this, a group working together has a greater potential for deeper understanding than an individual working alone.

Correlation

Currently there is no empirical evidence suggesting that there is a correlation between critical thinking and improved intelligence analysis because few have investigated the correlation. More importantly, evidence currently only shows a weak correlation between critical thinking training and improvements in thinking. Part of the problem is that there exist a plethora of critical thinking assessment techniques and tests. Each has its advantages and disadvantages but there seems to be no consensus on which is more effective. Each seems to measure a different aspect of critical thinking. The *Mental Measurement Yearbook* from the Buros Institute of Mental Measurements has a comprehensive list of reviews of critical thinking assessment tools and methodologies.

I found one paper that demonstrates an improvement in critical thinking after a program of training. Twardy (2004) found that argument maps statistically improved critical thinking on pre and post-test as measured by the California Critical Thinking Skills Test (CCTST). Argument maps are the visual representation of the structure of an argument. The rationale behind argument maps is that learners can visually identify the errors in the line of reasoning.

Current Intelligence Curriculums

As of 2003, the CIA Sherman Ken School for Intelligence analysts included critical thinking development as part of its curriculum. The NSA initiated a 40 hour program to enhance the critical thinking skills of analysts. In 2005, DIA started a similar program to develop critical thinking skills in their analysts. The Regional Joint Intelligence Training Facility in Molesworth, UK has a course on Critical Thinking and Structured Analysis. These are only a small sample of current programs available. It is obvious that there is an invested interest in promoting critical thinking in the intelligence community. The current curriculums seem to focus more intelligence analysis techniques than solely developing critical thinking. These intelligence analysis methodologies include techniques such as key assumption checks, analysis of competing hypothesis, alternative future analysis, red team analysis, team A/team B analysis, what if analysis, etc. Most of these techniques incorporate elements of critical thinking consistent with many of the components as discussed earlier such as a metacognitive or reflective component, a dispositional/attitudinal component, and criterion based thinking.

One interesting approach in training intelligence analysts is through the use of computer based games. The DIA had a \$2.6 million contract to develop three PC-based games for quickly training new analysts. All three games put the learner in the position of a young DIA analyst.

Each game plays out in 90 minutes to three hours with multiple story lines. Game based learning has been a hot topic for the DoD lately. It seems that research supports the notion of using games for learning. Becker (2005) noted the learning theory behind games by adopting Gagné's nine events of instruction inherently embedded in good video games to demonstrate why games are educational. These are: 1) gaining attention, 2) informing learner of objective, 3) stimulating recall of prior learning, 4) presenting the content, 5) providing learning guidance, 6) eliciting performance, 7) providing feedback, 8) assessing performance, and 9) enhancing retention and transfer.

Discussion

While it is apparent that there is an increased investment by the intelligence community in critical thinking curriculum, there currently is a lack of empirical evidence correlating improvement in analysis through critical thinking training. To resolve this, assessment methodologies for intelligence analysis must be thoroughly developed. Only then will researchers be able to objectively measure pre and post test results. Furthermore, for any critical thinking curriculum to be effective, the assumptions behind the program must be thoroughly defined. That is the skills and subskills of the program should be directed at promoting intelligence analysis and the teaching methodology should match the learner's level of ability.

Future efforts should investigate critical thinking in both the medical and business intelligence community. The problem structure in the medical community and business intelligence is very similar to intelligence analysis. For all three communities, they must sort through voluminous and disparate information, analyze and piece the data into a coherent picture, and finally develop a course of action to deal with the conclusion. For intelligence analyst they have to find information related to the problem, analyze the information, and produce actionable intelligence. For the medic personnel, they have to find the symptoms displayed in a patient, analyze the information to come to a diagnosis, and develop a course of treatment. And for business intelligence, an analyst must sort and vet through considerable amount of information such as customer behavior or competitor strategies, produce actionable intelligence, and develop business strategies to dominate the market. For all these communities this is a dynamic process. That is at any point during the process, new information may be found and the analysis must be reassess or reevaluate which may or may not change the course of action needed to deal with the situation. Furthermore, there is another commonality that a fair amount of deceit is purposefully used by the enemies to mislead the analyst.

By exploring how the medical and business intelligence community defines critical thinking and how they improve their analysis, we may find overlaps that are useful in promoting improvements in intelligence analysis.

Appendix A

Annotated Bibliography

Cadets Mark Bailie and Trent Atwood

Brightman, Harvey J. GSU Master Teacher Program: on Learning Styles. Georgia State

University. 2007. 25 May 2008 <<http://www2.gsu.edu/~dschjb/wwwmbti.html>>.

- Understanding how people best learn is important in the teaching process. This article attempts to explain how people learn and uses the information on learning to explain the best way to teach. Through the discussion of different types of students along with different teaching methods the reader becomes familiar with different ways to successfully teach.

Burbach, Mark, Gina S. Matkin, and Susan M. Fritz. "Teaching Critical Thinking in an Introductory Leadership Course Utilizing Active Learning Strategies: a Confirmatory Study." College Student Journal 38 (2004): 482-493. MasterFILE Premier. EBSCO. 4 June 2008.

- This study was conducted to determine whether an introductory level college leadership course that encouraged active learning increased *critical thinking* skills. A pre- and post-assessment of *critical thinking* skills was conducted using the Watson-Glaser *Critical Thinking* Appraisal. Significant increases were found in the Deduction and Interpretation subtests, and total *Critical Thinking*. Student engagement in active learning techniques within the context of studying interpersonal skills for leadership appeared to increase *critical thinking*. (Abstract)

Clark, Donald. Learning Domains or Bloom's Taxonomy. 3 June 2008

<<http://www.nwlink.com/~donclark/hrd/bloom.html>>.

- Here the types of learning are broken down into three groups. Within each group they are further broken down and given examples. This article allows for a better comprehension of the types of learning to appeal to as well as to develop.

Hatcher, Donald. On Assessing and Comparing Critical Thinking Programs: a Response to Hitchcock. Baker University.

- The author analyzes a report done on different methods of developing critical thinking and analyzing it. His work focuses mostly on comparing and critiquing Hitchcock's analysis on the same problem. Through this critique he manages to give insight into the different ways of developing critical thinking skills through courses. The article is finished with comparative statistics on test scores.

Heuer, Richards J. United States. Central Intelligence Agency. Psychology of Intelligence Analysis. 1999.

- A comprehensive review of cognitive literature in search of how people comprehend information and make decisions based on ambiguity. Touches on a number of topics related to cognition, metacognition, as well as intelligence analysis. The reader is also informed of different techniques for thinking as well as bias' to be aware of. Overall this report seeks to prepare analysts for advanced critical thinking skills and offers a method to do so.

Hopf-Weichel, R., J. R. Thompson, and R. E. Geiselman. The Cognitive Basis of Intelligence Analysis. U.S. Army Research Institute. United States Army, 1984.

- This report summarizes the background research that led to development of the "Strategic Intelligence Analysis Handbook" which was also developed under this contract. The goal of the research was to develop a framework for understanding human processes in intelligence analysis to be used in the development or evaluation of training procedures, doctrine, and system requirements for automated support to analysts.
(Abstract)

Jones, Anna. Teaching Critical Thinking: an Investigation of a Task in Introductory Macroeconomics. University of Melbourne. Higher Education Research & Development.

4 June 2008

<<http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=13310123&site=ehost-live>>.

- This paper is an investigation of understandings of critical thinking from two teaching perspectives: academic staff and tutors. It explores critical thinking as situated within an assessment task in introductory macroeconomics. This study found that while the two academic staff conceptualized critical thinking as a set of concrete cognitive skills, the tutors challenged this notion.

Katter, Robert V., Christine A. Montgomery, and John R. Thompson. Human Processes in Intelligence Analysis. Army Research Institute. United States Army, 1980.

- This report provides an overview of the results of a study entitled "Investigation of Methodologies and Techniques for Intelligence Analysis. The goal of this study was to develop a framework for understanding human processes in intelligence analysis. An understanding of these processes will be useful during the development or evaluation of training procedures, doctrine, and system requirements for automated support to analysts. (Abstract)

Moore, David T. Critical Thinking and Intelligence Analysis. National Defense Intelligence College. Washington DC: National Security Agency, 2007.

- Discusses the relationship between critical thinking and Intelligence Analysis. Through the observance of past examples in history and a thorough understanding and discussion of the topic, the authors discuss how to employ critical thinking and how to teach it in analysts.

Reiber, Steven, and Neil Thomason. "Creation of a National Institute for Analytic Methods." CIA. 15 Apr. 2007. CIA. 4 June 2008 <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol49no4/Analytic_Methods_7.htm#_ftn19>.

- While much has been written about how to improve intelligence analysis, this article will show *how to improve the process of improving analysis*. The key is to conduct scientific research to determine what works and what does not, and then to ensure that the Intelligence Community uses the results of this research. (Author's Introduction).

Sormunen, Carolee, and Marilyn Chalupa. "Critical Thinking Skills Research: Developing Evaluation Techniques." Journal of Education for Business 69 (1994): 172-178. EBSCOhost. 4 June 2008

<<http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=9403227533&site=ehost-live>>.

- Discusses the options when it comes to evaluating critical thinking skills. And emphasizes what is needed in the realm of critical thinking education and evaluation.

Yanchar, Stephen C., and Brent D. Slife. "Teaching Critical Thinking by Examining Assumptions." Teaching of Psychology 31 (2004): 85-90. PsycINFO. EBSCO. 4 June 2008.

- We describe how instructors can integrate the critical thinking skill of examining theoretical assumptions (e.g., determinism and materialism) and implications into psychology courses. In this instructional approach, students formulate questions that help them identify assumptions and implications, use those questions to identify and examine the assumptions and implications of theories being studied, and develop defensible positions on the tenability of various theoretical assumptions. (Abstract)

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